

**Assessment Annotations
for the Curriculum Frameworks**

Science

Grades 3, 7, and 10



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SCIENCE ASSESSMENT ANNOTATIONS

FOR THE

SCIENCE CURRICULUM FRAMEWORKS

The benchmark statements in the Science Curriculum Frameworks are at the second, fourth, eighth, and twelfth grades while the science portion of the Missouri Assessment Project will be given at the third, seventh, and tenth grades. In order to provide assistance in curriculum alignment to administrators, curriculum directors, and teachers concerning what is or is not “fair game” content for the science assessment, the attached document was developed by practicing classroom teachers and administrators.

This document includes the left-hand column (“What All Students Should Know”) and the center column (“What All Students Should Be Able To Do”) from the Science Curriculum Frameworks. The third column contains annotations about each benchmark as provided by several teacher work groups and is intended to provide guidance to **CTB/McGraw-Hill**, the assessment contractor. The first strand of the framework (Scientific Inquiry) was considered fair game at all grade levels and is not included in this document.

In the K-4 range, all of the benchmarks at grade two are “fair game” for assessment at grade 3. The benchmarks at grade four will have the words “Grade 3 state assessment” in the third column to denote a benchmark is “fair game” content or the words “Beyond grade 3 state assessment” to denote a benchmark that will not be considered at grade 3. Likewise, at the 5-8 range, the words “Grade 7 state assessment” or “Beyond grade 7 state assessment” will provide guidance. In the 9-12 range, the benchmarks will have annotations that say “Grade 10 state assessment” or “Beyond grade 10 state assessment.” Some of the annotations will be more specific and are self-explanatory. Not all benchmarks identified here as “fair game” for a state test will show up on the test in any given year.

Also, teacher work groups met in late **1996** and early 1997 to decide which of the seventy-three Show-Me Standards should be assessed on a statewide basis through the science performance assessment instrument. These teacher groups identified the following list of standards:

All of the Science Knowledge Standards

Performance Standards, Grade 3 :	1.3, 1.5, 1.6, 1.8, 1.10, 2.1, 3.5, 4.1
Performance Standards, Grades 7 & 10:	1.1, 1.3, 1.5, 1.6, 1.7, 1.10, 2.1, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 4.1

These standards will be the focus of the performance event of the science portion of the Missouri Assessment Project.

IV FORCE, MOTION, AND MECHANICAL ENERGY ASSESSMENT NOTES

(Show-Me Standards, Science 2)

A. Relative Motion

B. Types and properties of Forces and Motion

C. Interactions of Forces and Motion

K- 12 Content Overview:

Motion is as essential to understanding the physical world as matter and energy. Nothing is the universe is at rest and even things that appear to be a rest move. The description of how objects move depends on the frame of reference, but everything moves with respect to the sun and stars. Motion is described in terms of distance, displacement, speed, velocity, and acceleration. There are different types of motion, each with important properties, that can be combined into more complex forms. Types of motion include constant speed in a straight line, constant speed in a circle, acceleration in a straight line, and acceleration in a circular path. Relationships among these quantities are more easily interpreted and used to solve problems by means of graphical techniques involving slopes and areas under curves.

Four fundamental types of forces exist in the universe; gravitational, electromagnetic, strong nuclear force, and weak nuclear force. All other forces can be classified in terms of these four. Changes in the motion of objects are due to the effects of these forces. The size and direction of a force are important in order to determine the effect on the motion of an object. More than one force can act on an object at the same time and can make things move or keep them from moving, depending on the frame of reference.

IV Force, Motion, and Mechanical Energy A. Relative Motion

What All Students Should Know	What All Students Should Be Able To Do	Grade 3 Assessment Notes
<p><i>By the end of grade 2, all students should know that</i></p> <p>1. An object's position can be described relative to another object (above, below, left of, right of, behind, or in front).</p>	<p><i>By the end of grade 2, all students should be able to</i></p> <p>a. describe the position of an object relative to another object. (1.8; 1.10)</p>	Grade 3 state assessment
<p><i>By the end of grade 4, all students should know that</i></p> <p>2. An object's motion can be described in terms of another object (e.g., faster, slower) and how its position changes over time.</p>	<p><i>By the end of grade 4, all students should be able to</i></p> <p>a. compare one object's position and motion relative to another object. (1.6; 3.2; 3.3)</p>	Beyond grade 3 state assessment

IV Force, Motion, and Mechanical Energy B. Types/Properties of Forces and Motion

What All Students Should Know	What All Students Should Be Able To Do	Grade 3 Assessment Notes
<p><i>By the end of grade 2, all students should know that</i></p> <p>1. Forces explain many kinds of motion (e.g., stopping, starting, falling, straight, zigzag, circular, vibrational).</p>	<p><i>By the end of grade 2, all students should be able to</i></p> <p>a. express ideas on the type of motion an object is undergoing. (2.1; 2.4)</p>	Grade 3 state assessment
<p>2. Force is any push or pull exerted by one object on another.</p>	<p>a. identify the forces on a moving object and predict the direction it will go. (1.6)</p>	Grade 3 state assessment
<p>3. Weight is a measurement of the attraction of gravity on a mass. Mass is the amount of matter of an object.</p>	<p>a. use the appropriate tools to weigh an object then find its mass. (1.4; 1.6; 3.3)</p>	Grade 3 state assessment

What All Students Should Know	What All Students Should Be able To Do	Grade 3 Assessment Notes
<p><i>By the end of grade 4, all students should know that</i></p> <p>4. Forces can <i>be</i> mechanical, gravitational, magnetic, or electrostatic.</p>	<p><i>By the end of grade 4, all students should be able to</i></p> <p>a. demonstrate the force of gravity by using a scale. (2.1; 3.7; 4.1)</p> <p>b. design and conduct inquiries to study the effects of an electrostatic force on the motion of an object. (1.3;1.6)</p> <p>c. demonstrate and investigate magnetic force fields. (1.1; 1.2; 1.3; 1.4; 1.6; 2.1; 2.3; 3.2)</p>	Grade 3 state assessment

IV Force, Motion, and Mechanical Energy C. Interactions of Forces and Motions

What All Students Should Know	What All Students Should Be Able To Do	Grade 3 Assessment Notes
<p><i>By the end of grade 2, all students should know that</i></p> <p>1. Magnets attract and repel each other and certain kinds of metals.</p>	<p><i>By the end of grade 2, all students should be able to</i></p> <p>a. work as individuals and collaborate with others to identify the materials that are attracted to a magnet. (3.2; 4.6)</p>	Grade 3 state assessment
<p>2. The movement of an object depends on the force applied and how much mass it has.</p>	<p>a. identify and analyze how much force is needed to move a variety of objects. (1.6; 2.4; 3.3; 3.5; 4.1)</p>	Grade 3 state assessment
<p><i>By the end of grade 4, all students should know that</i></p> <p>3. An unbalanced force causes an object to change speed or direction. The magnitude of the change in speed or direction depends on the amount of force applied and the mass of the object.</p>	<p><i>By the end of grade 4, all students should be able to</i></p> <p>a. evaluate and describe the relationship of the amount of force applied to an object, the mass of the object, and the amount of change in the object's motion. (1.4; 1.6; 2.5; 3.1; 4.1)</p>	Grade 3 state assessment
<p>4. Simple machines are used to change the direction of an applied force and provide the mechanical advantage needed to move objects.</p>	<p>a. analyze and evaluate the way a simple machine increases the applied force. (1.1; 1.2; 1.3; 1.6; 2.1; 2.5; 4.1)</p>	Grade 3 state assessment Simple machines limited to gears and ramps

IV Force, Motion, and Mechanical Energy A. Relative Motion

What All Students Should Know	What All Students Should Be Able To Do	Grade 7 Assessment Notes
<p><i>By the end of grade 8, all students should know that</i></p> <p>1. The motion of an object can be described as a change in position, direction, and speed.</p>	<p><i>By the end of grade 8, all students should be able to</i></p> <p>a. use appropriate technologies to measure and compute the direction and magnitude of the forces causing the motions of common activities. (1.1; 1.3; 1.4; 3.5)</p>	Beyond grade 7 state assessment
<p>2. The motion of an object can be represented graphically in terms of direction over time, speed over time, or position over time.</p>	<p>a. organize data concerning the direction and position of a moving object with respect to time in a graphical form. (1.1; 1.2; 1.4; 1.8; 3.1; 3.5)</p>	Grade 7 state assessment
<p>3. Acceleration occurs when an object speeds up, slows down, or changes direction.</p>	<p>a. explain how an object's acceleration is affected by outside forces and its mass. (3.1; 3.3; 4.1)</p>	Grade 7 state assessment Only in the context of "speeds up" or "slows down"

IV Force, Motion, and Mechanical Energy B. Types/Properties of Forces and Motion

What All Students Should Know	What All Students Should Be Able To Do	Grade 7 Assessment Notes
<p><i>By the end of grade 8, all students should know that</i></p> <p>1. The overall effect of many forces acting on an object at the same time is called net force. The size and direction of this net force determines the change in motion of an object.</p>	<p><i>By the end of grade 8, all students should be able to</i></p> <p>a. use technologies to determine the direction of acceleration and the net force for an object moving in a circle. (1.3; 1.4; 1.6; 1.10; 4.1)</p>	Grade 7 state assessment
<p>2. Whenever an object exerts a force on another, an equal but opposite force is exerted back on it.</p>	<p>a. and define the forces necessary for an object to move or be in equilibrium. (1.4; 1.7; 2.1; 3.5; 3.7; 4.1)</p>	Grade 7 state assessment

What All Students Should Know	What All Students Should Be able To Do	Grade 7 Assessment Notes
3. Every object exerts a force on every other object. Its magnitude depends on the masses of the objects and the distance between them.	a. compare and describe the gravitational force between two objects. (1.4; 1.7; 2.1; 3.5; 3.7; 4.1)	Grade 7 state assessment

IV Force, Motion, and Mechanical Energy c. Interactions of Forces and Motion

What All Students Should Know	What All Students Should Be Able To Do	Grade 7 Assessment Notes
<p><i>By the end of grade 8, all students should know that</i></p> <p>1. Mechanical energy comes from the motion (kinetic energy) and/or position (potential energy) of an object.</p>	<p><i>By the end of grade 8, all students should be able to</i></p> <p>a. interpret and explain the relationship among kinetic energy, potential energy, and mechanical advantage. (1.6; 1.8; 2.1; 2.3; 2.5; 4.1)</p> <p>b. analyze the changes in kinetic and potential energy in common activities. (1.5; 4.1; 1.10)</p>	Grade 7 state assessment
2. The work done on an object depends on both the applied force and the distance an object moves.	a. Determine the amount of work done when an object is moved or when a task is performed. (1.5; 4.1; 1.10)	Grade 7 state assessment
3. Simple machines can be used to change the force on an object, its speed, or its direction of movement.	a. explain and demonstrate how common tools are simple machines and discuss the forces and motions involved. (1.1; 1.6; 1.10; 3.1; 3.6; 4.1)	Grade 7 state assessment

IV Force, Motion, and Mechanical Energy A. Relative Motion

What All Students Should Know	What All Students Should Be Able To Do	Grade 10 Assessment Notes
<p><i>By the end of grade 12, all students should know that</i></p> <ol style="list-style-type: none"> 1. Motion can be described in terms of velocity and acceleration and be represented by equations and vectors. 	<p><i>By the end of grade 12, all students should be able to</i></p> <ol style="list-style-type: none"> a. represent and analyze motion both quantitatively and graphically using velocity and acceleration. (1 .8; 2.4; 3.5; 4.1) 	<p>Grade 10 state assessment but not quantitatively</p>

IV Force, Motion, and Mechanical Energy B. Types/Properties of Forces and Motion

What All Students Should Know	What All Students Should Be Able To Do	Grade 10 Assessment Notes
<p><i>By the end of grade 12, all students should know that</i></p> <ol style="list-style-type: none"> 1. The acceleration of an object is related to its mass and the force acting on it. 	<p><i>By the end of grade 12, all students should be able to</i></p> <ol style="list-style-type: none"> a. analyze information from inquiries to interpret the effects of forces on velocity, acceleration, and equilibrium of an object. (1 .1; 1.4; 1.7, 3.5; 3.7; 4.1) 	<p>Grade 10 state assessment but not quantitatively</p>
<ol style="list-style-type: none"> 2. The action of all forces can be explained by Newton's Laws of Motion that are used to predict changes in linear and/or rotational motion. 	<ol style="list-style-type: none"> a. evaluate information to describe how Newton's Laws of Motion are used to describe moving objects. (1.7; 2.4; 3.4) 	<p>Grade 10 state assessment</p>
<ol style="list-style-type: none"> 3. Moving electric charges produce magnetic fields that exert a magnetic force on other objects; moving magnets can produce electric forces. 	<ol style="list-style-type: none"> a. select and apply appropriate strategies to investigate the relationship between a magnetic force and an electric current and devise a practical application using this relationship. (1.6; 1.10) 	<p>Grade 10 state assessment</p>

IV Force, Motion, and Mechanical Energy c. Interactions of Force and Motion

What All Students Should Know	What All Students Should Be Able To Do	Grade 10 Assessment Notes
<p><i>By the end of grade 12, all students should know that</i></p> <p>1. A force acting on an object, moving it through a distance, can change its kinetic energy, potential energy, or both</p>	<p><i>By the end of grade 12, all students should be able to</i></p> <p>a. describe the forces acting on a moving object that changes the object's kinetic and potential energy. (1.6; 1.10; 3.5; 4.6)</p>	Grade IO state assessment
<p>2. The ratio of output work to input energy is the efficiency of an machine or process and is always less than 100%. Power is the rate at which work is done.</p>	<p>a. analyze and describe the relationship among work, power, and efficiency. (1.6; 1.10; 2.4; 3.4; 4.1)</p>	Grade 10 state assessment
<p>3. The Law of Conservation of Momentum can be used to predict the outcome of collisions.</p>	<p>a. evaluate information to describe and discuss the result of a collision between two or more moving objects. (1.6; 2.3; 3.8)</p>	Grade IO state assessment Use no equations